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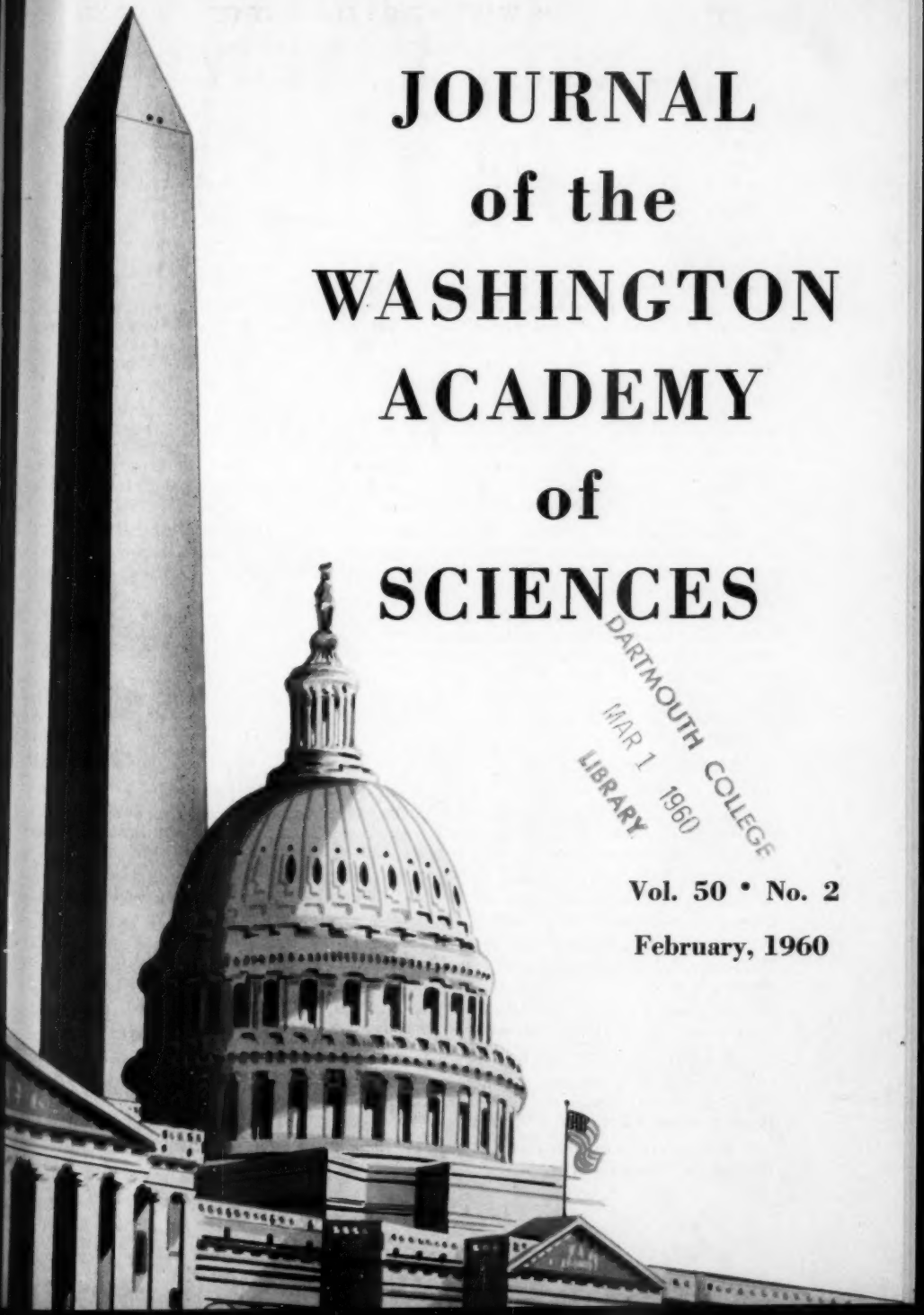
JOURNAL of the WASHINGTON ACADEMY of SCIENCES



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Contributors

ALBERT M. STONE, Applied Physics Laboratory
JOHN A. O'BRIEN, Jr., Catholic University
ELLIOTT B. ROBERTS, Coast & Geodetic Survey
MARGARET D. FOSTER, Geological Survey
RUSSELL B. STEVENS, Geo. Washington University
MODDIE D. TAYLOR, Howard University
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Adaptive Radiation in the Flowering Plants

Hui-Lin Li

Morris Arboretum, University of Pennsylvania

Introduction

The plasticity of living organisms is more obvious in the widely divergent adaptations, which are structural as well as functional, in some groups of animals, such as mammals and insects, than in flowering plants.[1] In these groups of animals, adaptive trends often are reflected in distinctive taxonomic groupings of major rank, such as families or orders. On the other hand, in flowering plants the major orders seemingly all occupy the same range of habitats and most of them have about the same range of types in their external appearance.

This leads Stebbins (1951) to state that "One of the most striking impressions which results from a comparison between the major subdivisions—families, orders, and classes—of the animal kingdom and the corresponding ones in the higher plants, is that while in animals the characters on which these subdivisions are based are for the most part of obvious adaptive significance, and must have evolved through the guidance of natural selection, in plants this is by no means the case."

This seemingly less obvious significance of adaptation in the classification of flowering plants is apparently due to their essentially similar methods of obtaining foods. As photosynthetic autotrophs, they all possess chlorophyll and a root system anchored permanently in the soil to absorb minerals. As the large majority of flowering plants adhere to this basic type of existence, it gives the impression that flowering plants as a whole are less versatile in differentiating into habitat groups along phylogenetic lines.

When all families of flowering plants are reviewed, actually many forms are to be found which are extraordinarily modified in adaptation to the most diverse environmental situations. These adaptations to the same environmental conditions are often repeated independently many times along different and distinct phylogenetic lines and resulted not infrequently in the formation of highly differentiated families or even orders.

The large majority of existing flowering plants are terrestrial plants inhabiting more or less mesophytic habitats. Radiating from this basic and generalized habitat, various other types of plants are evolved which are specialized for very different habitats and modes of existence.

Climbing plants

While the majority of these plants are autonomous, a number of them need support for ascending into the air up into the light. Adaptations for climbing are thus chiefly evident in a lengthening of the stems. This may result in the twining of the stems themselves or the development of modified accessory structures of attachment from the branches or leaves such as tendrils, adventitious roots and sensitive petioles. Climbing plants or klinophytes occur in numerous widely divergent families and among both herbaceous and woody plants. The following families are either exclusively or predominantly vines:

Actinidiaceae
Ancistocladaceae

[1] The term flowering plant is used in this paper as equivalent to angiosperms.

Convolvulaceae
Dioscoreaceae
Lardizabalaceae
Menispermaceae
Passifloraceae
Sargentodoxaceae
Schisandraceae
Vitaceae

Epiphytes

The climbing habit seems to lead in the family Marcgraviaceae into the epiphytic habit. Another essentially epiphytic family, but of an entirely different type of appearance, is the Bromeliaceae, which contains generally acaulescent herbs and are also eminently xerophytic. Epiphytic plants are also found scattered in many other large families, such as the Araliaceae, Ericaceae, Rubiaceae, etc. and are more particularly abundant in the Orchidaceae.

Saprophytes

Deviating from the basic photosynthetic autotrophic mode of nutrition, some plants become heterophytic either as saprophytes or parasites. Not a few flowering plants are saprophytes, deriving their nourishment from humus. Chlorophyll becomes unessential and thus disappears. The stems become yellowish or reddish and the leaves become scale-like. The subterranean rhizome or root system is solely responsible for absorption of nutrients. The individual plants thus become of very small size and the essential dominant feature is often the large inflorescence which is of prime importance for perpetuating the race. Saprophytic plants evolve independently in several distinct families such as the Orchidaceae and the Pyrolaceae. The family Triuridaceae, constituting solely the order Triuridales, is exclusively saprophytic. The family Burmanniaceae, with the exception of a few autotrophic species with greatly reduced green leaves, consists also of chlorophyll-less saprophytes. The family Pyrolaceae consists of strongly geophytic but independent plants (subfamily Pyroloideae) and saprophytes (subfamily Monotropoideae or sometimes treated as a distinct family Monotropaceae).

Parasites

Parasitism in flowering plants begins in hemiparasites, in which the plants remain green but live partially on the roots of other plants. It culminates in holoparasites in which chlorophyll disappears entirely and the plants depend solely on the host plants for nutrition. Parasitism occurs repeatedly and separately in different families, such as *Cassytha* in the Lauraceae and *Cuscuta* in the Convolvulaceae, and also notably in the tribes Geradieae and Rhinantheae of the Scrophulariaceae. The orders Balanophorales and Santalales consist mostly of parasitic plants. The families of these orders as well as other families entirely or predominantly of parasitic plants, including hemiparasites or holoparasites or both, are as follows:

Balanophoraceae
Cynomoriaceae
Hydnoraceae
Lennoaceae
Loranthaceae
Myzodendraceae
Orobanchaceae
Rafflesiaceae
Santalaceae

Geophytes

Among normally terrestrial plants, there are a large number of many different families assuming geophytic habitats. They frequently develop strong underground stems. Families like the Begoniaceae in the Dicotyledons and the Taccaceae and Zingiberaceae and many others in the Monocotyledons are distinctly geophytes persisting for a short or long period by thickened subterranean parts. In extreme cases the plants spend most of their life underground with parts appearing above ground only during a brief period of the year when flowering and fruiting are consummated very quickly. Such families as the Podophyllaceae and others contain nearly all members of the subterranean habitat.

Xerophytes

Plants adapted to extremely dessicated

situations in the deserts and steppes of the Old and New Worlds are found in many families, notably in the Gramineae, Liliaceae, etc. Some of these plants become succulents while others become highly sclerophyllous to check excessive transpiration. The xerophytic Cactaceae and Aizoaceae, predominant in America and Africa respectively, are especially notable. Lack of a large dominant family in the Asiatic deserts may indicate their relatively recent origin. The following families are predominantly xerophytes. The families Cactaceae, Casuarinaceae and Proteaceae are the sole members of the orders Cactales, Casuarinales and Proteales respectively.

Aizoaceae
Cactaceae
Casuarinaceae
Crassulaceae
Portulacaceae
Proteaceae
Tamaricaceae

Aquatic plants

Many large families of flowering plants contain some members that are adapted to the aquatic habitat such as the Ranunculaceae and Scrophulariaceae. A very considerable number of families in the Dicotyledons are solely aquatic or semi-aquatic in habitat. These hydrophytes assume a wide variety of structural differentiation modified for varied existence as floating or attached plants and living in still or rapidly running waters. While most of these are either completely submerged or floating some are adapted to marshy or semiaquatic habitats. These aquatic Dicotyledonous families are:

Barclayaceae
Callitrichaceae
Cabombaceae
Ceratophyllaceae
Elatinaceae
Euryalaceae
Haloragaceae
Hippuridaceae
Hydrostachyaceae
Nelumbonaceae
Nymphaeaceae
Podostomaceae
Tristichaceae
Trapaceae
Trapellaceae

The aquatic habitat is especially predominant in the Monocotyledons, a large proportion of which are aquatics or semi-aquatics. The large order Helobiales contains eight families entirely of hydrophytes. The aquatic families in the Monocotyledons are as follows: (These include plants living in freshwater as well as in brackish water and in the sea).

Alismaceae
Aponogetonaceae
Butomaceae
Hydrocharitaceae
Juncaginaceae
Lemnaceae
Najadaceae
Pontederiaceae
Potamogetonaceae
Sparganiaceae
Typhaceae
Zanichelliaceae

A distinct type of aquatic adaptation is manifested by the so-called mangrove plants with highly specialized modifications in vegetative as well as reproductive structures to survive and perpetuate along muddy coasts and estuaries in the tropics. The most notable modifications are aerial roots and viviparous germination. Mangrove plants are found in the families Sonneratiaceae, Combretaceae, Verbenaceae, etc. The family Rhizophoraceae consists entirely of mangrove plants.

Insectivorous plants

A very special trend of adaptation in plants is the insectivorous or carnivorous habitat which seems to be associated with semi-aquatic habitats where insect life is especially abundant. The order Sarraceniales [2] is entirely insectivorous, with

[2] The Sarraceniales, while generally recognized as an order, are found by many authors to be a composite group of unrelated stocks. The family Nepenthaceae should probably be more appropriately included in the Aristolochiales and the Droseraceae either in the Parietales or the Rosales.

the three families Droseraceae, Nepenthaceae and Sarraceniaceae developing very different structural modifications in their leaves for trapping and digesting insects as a means of nutrition. The large predominently aquatic and insectivorous Lentibulariaceae are of an entirely different phylogenetic stock, of the order Tubiflorae. Another order, the monotypic Cephalotales, with one family of a single species, is also an unique insectivorous plant.

Discussions

The above brief account summarizes the versatile adaptability of the flowering plants, in spite of the limitation in their method of obtaining food. It seems that in the flowering plants there is an inherent potential of evolution to adapt themselves to widely different environmental conditions just as in some groups of animals. As is generally believed and for instance summarized by Stebbins (1950), all long continued evolutionary trends in plants as well as in animals apparently occur through a progressive series of random mutations guided by natural selection. Recently, Waddington (1953), while discrediting the inheritance of acquired characters, considers this current biological belief as an extreme view and postulates a hypothesis of genetic assimilation of such characters, which thus become hereditarily fixed. The whole problem is in need of much more experimental study than has now been made.

The number of plant families recognizable mainly by their adaptive features is impressive. Among these 27 or over 10 percent are entirely aquatic in habitat. Ten families or about 4 percent are climbing plants. Seven families or about 3 percent are solely adapted to dry situations. Similarly 9 families or about 4 percent are wholly parasitic plants. Five families or about 2 percent are adapted to the very unique insectivorous habitat. In view of their immobility and their similar mode of obtaining food, these figures, showing major groupings of flowering plants differentiated by means of adaptive trends, are surprisingly high. This situation compares favorably with the conditions expressed in the mammals which have the different orders occupying different habitats. In addition to the seed habit, the adaptability of the flowering plants is largely responsible for the dominant position they hold in the plant world of today.

The different adaptive trends in these plants require structural modifications of considerable magnitude, not only in internal organization but also in gross outward appearance. The difference in appearance between an aquatic Ceratophyllum, a parasitic Rafflesia and a xerophytic Cactus is as great as if not greater than that between an aquatic whale, a volant bat and a fossorial gopher. It is natural that these modifications in the plants are manifested in vegetative parts like roots, stems and leaves, while the reproductive organs and the methods of reproduction remain little changed. The same is also true in animals.

It seems that botanists on the whole lay more emphasis on the evolutionary significance of reproductive structures than zoologists and consequently overlook generally the relative importance of vegetative structures in phylogeny. Perhaps this is true only in the study of higher plants as habitats are generally recognized as of great importance in the major divisions of lower plants. For instance, if habitats are not considered as of prime importance, some of the Chlorophyceae would perhaps assume closer relationship in phylogenetic schemes with some of the Phycomycetes than among their respective selves.

The various trends of adaptation in the flowering plants seem to radiate from a more generalized terrestrial and moist mesophytic habitat. In other words they represent derivative types. While the relationships of some of these specialized families are uncertain or disputed, the kinships of many others are well established and generally recognized from morphological and anatomical studies.

For instance, among the parasitic families, the Hydnoraceae are regarded as derived from the large family Aristolochiaceae

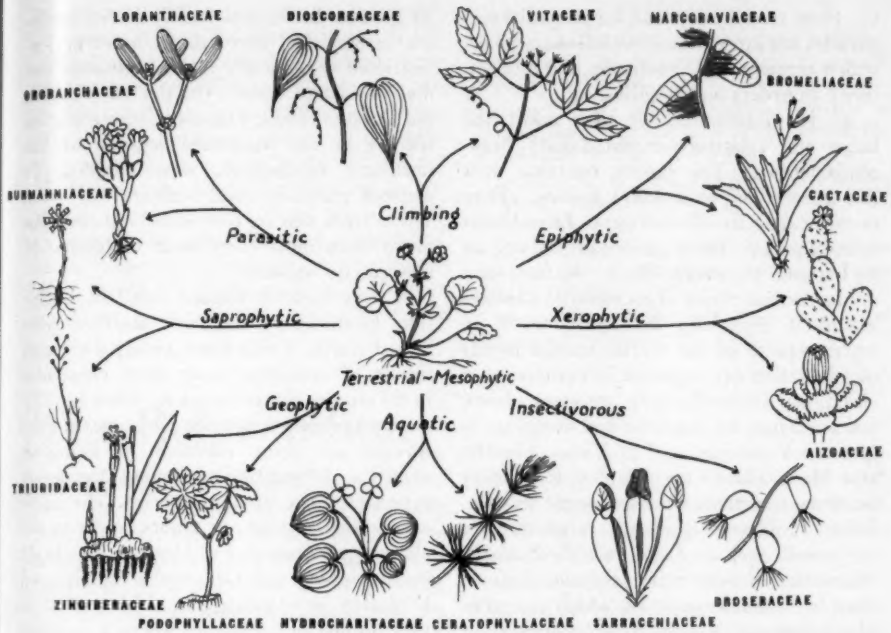

Fig. 1. Diagram of parallelism in evolution and adaptive radiation in the flowering plants.

and the Orobanchaceae from the large family Scrophulariaceae. Similarly among the aquatic plants, the Ceratophyllaceae are supposed to be modified types derived from the Onagraceae, the Trapellaceae from the Pedaliaceae, and the Podostomaceae probably from the Saxifragaceae. Among the others, the mangrove family Rhizophoraceae are probably derived from the Lythraceae, the essentially saprophytic Monotropaceae from the Pyrolaceae and Ericaceae, and the essentially epiphytic Marcgraviaceae from the Ternstroemiaceae.

This situation is comparable to that occurring in the mammals although in the latter, habitat groups are often differentiated at ordinal ranks such as the Chiroptera, an entirely volant group, and the Cetacea, an entirely aquatic group. In others, however, such as the Carnivora, the component groups are adapted to various different habitats as digging, swimming, and walking forms, a situation very similar to most of the larger orders or families of the flowering plants.

It is clear that these various adaptive trends occur repeatedly and independently at different times and from different stocks. This serves to show not only adaptive radiation but also parallelism in evolution in the flowering plants (Figure 1).

As stated above, these trends of adaptation in the flowering plants are sometimes manifested in entire families and orders but also in genera and species among other families. This differentiation presumably has some significance in the relative age of these groups, although the difference in the rate of evolution should also be considered. However, little can be said on either case at our present state of knowledge.

It does seem clear that the flowering plants as a whole are inherent in their great adaptability. In large families, these various trends are sometimes manifested within a single family. As the time goes

on, these trends may lead on to additional parallel but independent evolutionary peaks which represent taxonomically and momentarily as orders and families.

As an illustration, we may select the large and relatively recent family Scrophulariaceae. The family contains over 250 genera and over 3,000 species. They occur widely in all continents from warm to cold parts. There are woody as well as herbaceous members. While the majority are terrestrial plants of mesophytic habitats abundant especially in moist lands in warmer parts of the world, special trends of adaptation are apparent in various other situations. Generally they are erect plants, but some may be prostrate and creeping, as in some Veronicas, and in *Mazus, Linaria,* etc. Many plants are adapted to marshy habitats and true aquatics occur in *Ambulia, Hydrotriche,* etc. A large number of genera, such as *Euphrasia, Pedicularis, Odontites, Melampyrum, Bartsia, Rhinanthus,* etc. are hemiparasites which are green plants but attach themselves by suckers or the reduced lateral roots to roots of grasses. In *Lathraea, Harveya* and *Hyobanche,* there are true parasites devoid of chlorophyll. The same trend apparently leads into the development of the wholly parasitic family Orobanchaceae. The insectivorous Lentibulariaceae are related and probably derived from the Scrophulariaceae.

On the generic level, habitat groups circumscribed as taxonomic entities are very numerous and are found in nearly all large families. There are many large and ecologically variable genera such as the oaks and willows. However, many smaller genera are adapted to narrow ecological niches. Some such habitat groups are highly specialized and are thus distinctly recognizable, such as the already mentioned parasitic genera *Cassytha* in the Lauraceae and *Cuscuta* in the Convolvulaceae. Others are of a more subtle nature, but their distinct adaptive trends often also become apparent upon closer scrutiny.

In the later category, we may select at random a few examples. In the genus *Alnus,* the Alders, although there are some 30 species distributed widely in the northern hemisphere, they are all more or less restricted ecologically to cool climates and moisture-laden soils. On the other hand, the Chestnut trees, *Castanea,* with some 10 species in the temperate regions of the northern hemisphere, are adapted to warmer situations and well-drained soils. These trees can in fact withstand drought better than most other trees of temperate mesophytic habitats.

A very notable feature in plant evolution, as shown by the many families mentioned above, is that these widely divergent trends of evolution occur most especially in the tropics and subtropics. Bews (1927) has demonstrated that the moist warm conditions are most effective in bringing about a differentiation among the most primitive types of angiosperms. The various derivative types of plants as discussed above are shown by him to originate mostly under moist favorable conditions. Evolution is apparently a subject that is best studied in the tropics where it is being carried on by nature on the fullest scale and at the fastest rate. Our knowledge of evolution will certainly be greatly augmented as we know more about the development of tropical vegetation.

The above mentioned author has made a very important contribution in his attempt to ascertain plant phylogeny from an ecological point of view, which he called ecological evolution. The study of plant taxonomy and plant phylogeny has much to gain from a geographical approach, which in this sense is used to include ecology. The advantage of this approach in plant taxonomy has been amply demonstrated by many modern monographical and revisional studies. As indicated by Camp (1947) and others, its advantage in studying phylogeny is equally promising.

Summary

Among the flowering plants, specialized habitat groups are developed parallelly along different phylogenetic lines. These are usually accompanied by pronounced structural modifications and often resulted in

the differentiation of major taxonomic groupings such as families or orders. Radiating from a generalized terrestrial mesophytic focus, trends of adaptation are particularly notable for climbing, epiphytic, saprophytic, parasitic, geophytic, xerophytic, aquatic, and insectivorous habitats. There are many whole families that follow strictly one of these lines of adaptive radiation. The great inherent adaptability of the flowering plants is largely responsible, in addition to the seed habit, for their dominant position in the plant world of today.

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The Referendum

The results of the referendum on the contents of the *Journal of the Washington Academy of Sciences* reveal that the membership is divided into three parts. The largest group is indifferent to the question, the next largest wants a change, and the third group, a vociferous minority, wants the *Journal* to remain a primary research publication. It is clear that the best compromise would require two publications: one like the *Journal* of the past, the other a house organ. At present the Academy cannot afford to publish two periodicals; it cannot even afford to maintain the *Journal* as it was. Therefore an attempt will be made to please the long-suffering majority with a smaller journal of scientific thought and action characteristic of the Academy.

Although we would have accepted a mandate to maintain an archival periodical, our heart would not have been in it. We are not among the minority who believe that the most important function of the Academy is to publish an archival journal. We are not impressed by those who cry that the Academy will lose its dignity, prestige, or reputation if the old *Journal* is not continued.

The practice of publishing in one journal research articles in all fields of natural science is a venerable one and is maintained by the Royal Society, the National Academy of Sciences, and many other academies. No doubt the prestige thought to be connected with such a practice flows down from the old and very distinguished scientific organizations that adopted it of necessity before the rise of specialized scientific societies and their journals and other outlets for the publication of scientific work. Now that natural science has become highly specialized, it takes great prestige to draw good research articles away from specialized journals into over-all journals. The Washington Academy, having relatively little prestige, could get for its journal as a rule only descriptive articles that become effective after they arrive upon library shelves. To a taxonomist it does not matter where his article is published so long as he can get reprints and a good distribution of it in the libraries of the world.

We zealously advocate and defend the need for more systematic work in the life and earth sciences and for its prompt and complete publication and pertinent distribution. At the same time we contend that systematic articles should not be published in the *Journal of the Washington Academy of Sciences*, because it is unfair to accept subsidy for their publication from unwilling scientists and wasteful to distribute them among people who do not need them. We

believe that systematists should re-examine their publication requirements and the means of meeting them in the 1960's.

At present most archival papers are written and offered for publication by professional scientists; i.e., by those who are paid to work in the field on which they write. We believe that a continuous and persistent effort should be made by these workers and all other professional scientists to convince their employers that the cost of publication is an integral part of the cost of scientific work and must be paid for in full by the employer. Looking to the future when the problem of storage, filing, and transportation of special libraries will become acute, we feel that very serious consideration should be given to the original publication of systematic articles on microcards. There is a tendency to dismiss this less expensive, faster, and more manageable system because the present International Rules do not recognize species described in microfilm. Would it not, however, be more progressive to begin to use microcards and press for the improvement of readers and the repeal of the repressive rule?

The Academy should not disregard this problem but, perhaps through the work of a special committee, should try to increase outlets for publication of taxonomic papers. For a time during a period of transition grants might be made from the reserve fund of the Academy to assist publication of professional taxonomic papers in such local journals as that of the Biological Society and of the Entomological Society. We also hope there will always be amateurs at work whose publications ought to receive support from private funds.

Our colleagues who are genuinely concerned about the effect our new publication policy may have on the alleged prestige of the Academy should be invited to state their case in this column as frankly as we have presented our point of view. We do not believe that recent publication of professional scientific research in the *Journal* reflects much credit on the Academy. The work would have been done and no doubt published whether the Academy existed or not. The Academy, as such, usually has played no part in the initiation, guidance, or criticism of the research published in its *Journal;* it has served only as a publisher and payer of bills that should have been paid by the employer. The Academy really counts in those activities that require organized effort toward the promotion of science in the Washington area. In such effort we can take pride and we can make known our work and stimulate our members and many others through the *Journal.*

Frank L. Campbell

Dr. Lawrence A. Wood

1960 President of the Washington Academy of Sciences

At the 62nd Annual Meeting and Banquet of the Washington Academy of Sciences, which was held on Thursday, January 21, 1960, at the John Wesley Powell Auditorium in Washington, D. C., Dr. Lawrence A. Wood was installed as the society's President for the year 1960.

Dr. Wood was born in Peekskill, N. Y. in 1904. He received an AB degree in chemistry and mathematics from Hamilton College in 1925. He then transferred to Cornell University for his graduate work, where he changed his field of science to physics and received his PhD degree in 1932. He remained at Cornell as an instructor in physics for three years, where he conducted research and published papers in the field of electricity, and then came to the National Bureau of Standards as a member of the Rubber Section. In 1943 he became chief of this section, a position which he still holds today.

Dr. Lawrence A. Wood

Dr. Wood's early research work on rubber was concerned with measurement and interpretation of the basic physical constants and properties of natural rubber. However, his interests later turned toward the synthetic rubbers, and his subsequent experience with these new materials proved to be extremely valuable to rubber science and technology. In 1940, when very few people realized the importance of synthetic rubbers, he prepared an excellent comprehensive review article on the composition, properties, and uses of various synthetic rubbers. This paper was published as a National Bureau of Standards Circular, and the demand for it was so great that several reprintings were required by the Government. Because of its timeliness and importance it was translated by the Germans and the Japanese into their languages and printed in their journals.

Dr. Wood is the author or coauthor of more than forty other scientific papers. His early research with rubber was concerned largely with transitions; and as a result of his excellent work in this field he was selected to prepare the chapter on "Crystallization Phenomena in Natural and Synthetic Rubbers" for a book "Advances in Colloid Sciences," published in 1946. He was also selected to write the chapter on "Physical Chemistry of Synthetic Rubbers" for a comprehensive treatise on "Synthetic Rubbers" published in 1954. In 1938, and again in 1948, Dr. Wood was an official delegate from the U.S. Department of Commerce to an International Rubber Conference held in London, England. At both of these meetings he presented invited papers.

As a result of Dr. Wood's recognition as an outstanding authority on synthetic rubber he is called upon very frequently for advice by many Government agencies. He has collaborated with many of them and also with several congressional committees, furnishing them with technical advice and recommendations for guidance on synthetic rubber problems. Several times during World War II he was called into private conferences with the Secretary of Commerce, the Honorable Jesse Jones, concerning vital problems related to the Government's production of synthetic rubber.

For his excellent work and outstanding achievements in research he received in 1943 the Physical Science Award of the Washington Academy of Sciences. In 1958 he also received the Meritorious Service Award from the U.S. Department of Commerce for his valuable fundamental contributions to the science and technology of rubber.

Dr. Wood has always shown a great interest in scientific societies, both locally and nationally. In addition to being a member of the Washington Academy of Sciences he is also a member of the Philosophical Society of Washington and the American Chemical Society and is a Fellow of the American Physical Society. He was one of the founders of the Division of High Polymer Physics of the American Physical Society and has held several offices in this Division, including the chairmanship in 1947. He has also held various offices in the Philosophical Society of Washington, including its Presidency in 1955. Because of Dr. Wood's distinguished career as a scientist and because of his interest and activities in the WAS and other societies, the Washington Academy of Sciences is to be congratulated on its choice of President for 1960. **Norman Bekkedahl**

Academy Activities in 1959

A Report to Nonresident Members

Frank L. Campbell, *Retiring President*

It occurred to me that nonresident members of the Washington Academy of Sciences, who could not attend the Annual Meeting on January 21, would like to have some idea of what the Academy was doing last year. Let me try to report briefly to you as I did to those present at the annual meeting.

The Board of Managers

The Academy is governed by a large Board of Managers consisting of seven officers, six elected members-at-large, and representatives of 26 affiliated local scientific and engineering societies, who have been called vice-presidents of the Academy. These 39 people are expected to meet on the third Tuesday of each month, except July, August, and September. There is a regular order of business calling for reports of the officers, of 13 standing committees, and of whatever special committees are active. Therefore up to 17 chairmen of committees should also appear at Board meetings. These members, plus our paid administrative secretary, add up to a throng of 57 people who might gather for meetings of the Board, which in 1959 were held between 8 and 10 p.m. in the so-called Reading Room of the National Academy of Sciences—National Research Council. Of course no such number ever appeared, but attendance at regular meetings was remarkably good. There is also an Executive Committee consisting of five of the above officers, which often met prior to Board meetings to study and make recommendations to the Board on fiscal matters.

The Board meetings of 1959 departed from the routine, regular order of business at nearly every meeting. Two subjects were of principal concern to the Board: (1) the recommendation of the Executive Committee that dues be increased from $6 to $10 per year and (2) revision of the Bylaws. Both questions would have to go to the membership for approval by mail ballot.

The Journal of the Academy

The first question became connected with the cost of operating a central office and of publishing the *Journal of the Washington Academy of Sciences* because both were responsible for the operating deficit that made necessary an attempt to increase dues. The Board did not attack the central office, but did challenge the *Journal*, calling it a publication not worth to most of the members the money being spent on it. The Committee on Policy and Planning and that on Ways and Means were asked to study the problem and report. The answers did not come easily and are still tentative. The Board favored a change in the character of the *Journal* and gave the president the authority to appoint a volunteer staff that could do more than receive and process manuscripts for publication—a staff that could solicit material, write and rewrite, and establish communication among the members of the Academy and its affiliated societies. The experiment on the *Journal*, as you see, is underway and we want your comments and criticisms, knowing that we cannot please everyone. Please bear in mind, too, that we are allowed only $4,000 to spend on the *Journal* in 1960, whereas $10,000 were spent on it in 1959. The decision of the Board to change the character of the *Journal* was supported by a referendum to the membership.

Revision of the Bylaws

A thorough revision of the Bylaws required hours of the Board's time for discussion of controversial items. Thanks to the willingness of some members to attend

two special meetings of the Board the job was finished (temporarily, of course) in 1959. The revised Bylaws will soon go to the membership for approval. An explanation of substantive changes will accompany the document. I might say here that the Board thought it somewhat ridiculous for the Academy to have 26 vice presidents and to require that they be elected (en masse!) at the annual meeting of the Academy. The revised Bylaws will call them Delegates from the affiliated societies, and the Academy will seat whomever is designated by the affiliated society, provided he is a member of the Academy. There is now a move afoot to make these delegates members of a new Council of the Academy, analogous to the Council of the AAAS. Thus the Board of Managers would be relieved of the weight of their numbers at most Board meetings and yet could get advice from them from time to time, particularly on questions affecting the affiliated societies.

The Joint Board

Enough for the Board of Managers, for there is another Board that should be known to you. I refer to the Joint Board on Science Education for the Washington Area, usually known locally as "the Joint Board." It is composed of the Committee on Science Education of the Academy and a similar group from the D. C. Council of Engineering and Architectural Societies. The Joint Board has its own budget, committees, and meetings and takes only policy direction from the Academy. It effectively helps students and teachers of science in this area, particularly those in the secondary schools. Its Secondary School Contacts Committee provides liaison between every junior and senior high school, public, private, and parochial, in this area and the professional scientific and engineering community. There is a contact man or woman for every school, to help in any way he can. And back of him are large numbers of volunteers who will lecture, teach, counsel, demonstrate, or evaluate as needed. Just the bookkeeping on the roster of volunteers is a large task. Beginning in 1959, thanks to the National Science Foundation and the central office of the Academy, an assistant could be employed to bring the roster up to date, maintain, and operate it. This was one of four projects supported by a grant of $35,000 from the new Academy program of NSF. Our Academy was ready for it and was among the first to receive this support. Two other projects have to do with experimental teaching in elementary and secondary schools, combining mathematics and science, with advice from special committees of the Joint Board. The fourth project brings together for free discussion teachers in secondary schools and universities and scientists in government or private employment on the general topic of improving science education leading to careers in science. All these projects have been under way since last September, and support for a second year has already been requested.

All secondary school teachers are kept informed of Joint Board activities through a monthly 8-page newspaper written and edited by a member of the Board. It is supported by a grant from a private foundation.

In addition to contact work with the schools, the Board is concerned with local science fairs, sending the winners to the national fair, participating in an annual event of the D. C. Council called Engineers, Scientists, and Architects Day, etc.

The Office of the Academy

You have noted that I have so far not mentioned the names of people on or connected with the Board of Managers of the Academy or with the Joint Board. I have omitted them deliberately because there are so many to whom credit is due. I could not name them all even if I would. You will learn the names of many as you read the new *Journal*. However, I do want to mention here our Administrative Secretary, Mrs. R. R. Fell, a woman of unusual competence who works full time for a modest salary in our central office in the room that the Carnegie Institution of Washington has

provided free of charge for the Academy's use. It is just to the right of the entrance of the Carnegie building at 1530 P Street N.W. It is open only during working hours, from 8:30 to 5:30 Monday through Friday. I suggest you drop in when you are in Washington. There you will find Mrs. Fell and Miss Juliette Grant, Assistant to the Joint Board, and you will then appreciate the work they are doing.

I helped to set up the central office in the summer of 1958 when Mrs. Fell came to us from the University of Virginia. It was in full operation in 1959. First Mrs. Fell took over the business of getting out the weekly Science Calendar, a list of meeting announcements of local scientific and engineering societies that is published in the local newspapers. Gradually as the records and materials of the secretary, treasurer, custodian, and archivist were brought into the office, she undertook the routine work of bookkeeping, membership records, filling orders for back issues of the *Journal*, etc.—everything that should be done in the office of a society. She also helped to revise the directory of the Academy's membership, which was published recently, and summarized many of the voluminous minutes of the secretary. More and more the office is serving as the most convenient source of information about the Academy and the Joint Board and their work; the telephone is busy.

I have tried to give you a picture of Mrs. Fell's work so that you can answer anyone who tells you that the office is an unnecessary luxury. As a matter of fact, Mrs. Fell is now doing regularly and well necessary work that some of our volunteer officers did irregularly and incompletely. Her work on *Journal* subscriptions, reprints, and sales of back issues brought in gross receipts greater than the amount of her salary.

Report of the Treasurer

At this point I suggest you look at the appended summary financial report for 1959. You will see that although we had an operating deficit of more than $4,000, the value of the Academy's investments suffered little loss during the year. There is no need to build up this reserve any further; on the other hand, it could be seriously reduced if we should continue to spend more than we receive. That is the reason for curtailing expenditures on the *Journal* in 1960. An increase in dues or in membership or both will permit an expanding *Journal*. On the other hand, income from subscriptions to the *Journal* will probably diminish, because it will no longer be an archival publication that libraries must keep.

Membership

In 1959 a well-organized, hard-working membership committee prevented any net loss of dues-paying members and the total membership increased from 1066 to 1083. In 1960 there may well be a temporary net loss of dues-paying members owing to impulsive resignations of some who opposed a change in the character of the *Journal*. But these defections should soon be overcome by new members who will like a journal that keeps them informed about scientific activities in their own community. The growth of the Academy could be very rapid if it will admit all who are interested or may become interested. The present members, who are persons of considerable experience and achivement in science, could become Fellows of the Academy, and people of all ages without special qualifications could become members and make the work of the Academy in the scientific community more cooperative and less benevolent.

Meetings

The Academy holds eight meetings per year on the third Thursday of the month including the annual dinner meeting in January. In 1959 the annual meeting was held at the Kennedy-Warren apartments. The officers' reports and Academy awards were presented at the annual meeting. In February the meeting was held in the John Wesley Powell auditorium of the Cosmos Club. Retiring President McPher-

son gave a remarkable address on food and civilization, from the beginning of agriculture to the future when expanding populations may require production of food by chemical industry. In March the Academy met jointly with the Junior Academy in the auditorium of the U. S. National Museum to hear Dr. F. O. Rice and recognize members of the Junior Academy who had distinguished themselves in the National Science Talent Search. The next three meetings were held in the Powell Auditorium. In April two Academy award winners, Drs. Bolton and Branscomb, talked about their work in biophysics and physics respectively. In May the Academy was addressed by Dr. Hugh L. Dryden on space science, in October by Dr. Edward Teller on Project Plowshare, the constructive utilization of atomic explosions. In November members of the Academy met for dinner at the Johns Hopkins Applied Physics Laboratory in Howard County, Md. After dinner some of the laboratories were opened for inspection and then a meeting was held in the Laboratory's auditorium at which Academy award winners Rubin and Shen spoke about their work in radiocarbon dating and aeronautical engineering, respectively. The December meeting in the Powell Auditorium was addressed by Mr. Willard Bascom on the Mohole, the project of the American Miscellaneous Society to take a sample of the mantle of the earth and of all that lies above it on the bottom of the deep ocean. All nondinner meetings of the Academy were preceded by small dinners at which the officers entertained the speakers, and all meetings in the Powell Auditorium were followed by light refreshments for all.

Awards for Scientific Achievement

In the preceding paragraph Academy awards were mentioned. These are certificates of merit in the biological sciences, the physical sciences, the engineering sciences, and in teaching. In 1959 for the first time an award was made in mathematics. Each of these fields was represented by a carefully selected panel of six or seven Academy members, each a scholar in his own subject. The task of obtaining nominations, coordinating the work of the panels, and reporting the results was done by the chairman of the overall committee. These awards, established in 1939, have been very significant as shown by the subsequent careers of the young men and women who have received them. Award winners are invited to become members of the Academy, if they were previously overlooked.

Encouragement of Science Talent

A committee on this subject pays particular attention to the Washington Junior Academy of Sciences. In 1959 it had a hand or a voice in various activities of the Junior Academy: The Science Fair; the Science Talent Search; the Science Trip to New York; the first Science Conference, an all-day paper-reading session at the Burlington Hotel attended by 150 high school students, the meetings of the Governing Council, etc. In addition the Committee sponsored a summer research program that gave selected students an opportunity to work without remuneration at the National Institutes of Health. Of course, this committee cooperates with the Joint Board. We are very proud of its altruistic work among the junior scientists of this area.

Miscellaneous

In 1959 the Washington Section of the American Nuclear Society became affiliated with the Academy.

The Academy's second monograph, on microsomal particles, was published by Pergamon Press and had a satisfying sale.

Two small grants-in-aid for research were made to high school students, who requested support of less than $100 each for the purchase of supplies and equipment for their projects on the speed of light and paper chromatography.

Aided by representations from a special committee of the Academy on the need for science service in the Library of Congress after the usual working hours, the Librarian succeeded in getting support for longer Library hours.

Summary Financial Report for 1959

Washington Academy of Sciences
W. G. Brombacher, Treasurer

RECEIPTS

Dues	$5,377.50
Journal subscriptions and reprints	4,572.33
Sales of back numbers of the Journal	1,096.59
Interest and Dividends	3,413.20
Miscellaneous Income	90.60
Total income, 1959	$14,550.22

EXPENDITURES

Journal: Printing, reprints, editorial assistant (11 issues)		$10,712.55
Routine operations; officers and meetings		2,231.62
Headquarters office expense		4,884.75
Membership certificates (backlog cleared up)		338.99
Joint Board, Science Education		500.00
Science calendar		75.00
Total expenditures, closely, in 1959		$18,742.91
Deficit, 1959 operations	$4,192.64	
Cash balance, WAS only, December 31, 1958		$6,919.16
Bonds matured and cashed		2,000.00
Savings bank account closed out		1,586.25
Cash balance, WAS only, December 31, 1959		6,321.82
Investments, WAS only		
Value, December 31, 1958 (includes savings account)		$70,218.98
Value, December 31, 1959		70,097.88
Junior Academy		
In checking account,		
December 31, 1958		$833.59
December 31, 1959		1,337.04
In savings account, American Security & Trust Co., Dec. 31, 1959		2,000.00
Grant, National Science Foundation		
June 1959		$35,250.00
Expended to December 31, 1959		13,512.92
Balance in checking account, December 31, 1959		$21,737.08
Grand total in checking account, December 31, 1959		$29,395.94

Science in Washington

SCIENTISTS IN THE NEWS

This column will present brief items concerning the activities of members of the Academy. Such items may include notices of talks given, important conferences or visits, promotions, awards, election to membership or office in scientific and technical societies, appointment to technical committees, civic activities, and marriages, births, and other family news.

Formal contributors are being assigned for the systematic collection of news at institutions employing considerable numbers of Academy members (see list on masthead). However, for the bulk of the membership, we must rely on individuals to send us news concerning themselves and their friends. Contributions may be addressed to S. B. Detwiler, Jr., Associate Editor, 2605 S. 8th St., Arlington, Va.

Catholic University

Virginia F. Griffing, professor of chemistry, participated in a Symposium on "Comparative Effects of Various Radiations," held February 15-20 under the auspices of the NAS Photobiology Subcommittee. The meetings took place on the Rio Piedras campus of the University of Puerto Rico.

Regina F. Herzfeld, professor of anthropology, presented a paper entitled "The Missionary's Knowledge of Local Language and Culture" at the Fordham University Conference of Mission Specialists, January 23-24.

Herbert C. Hanson, research professor of biology, has been elected first vice-chairman for 1960 of the Capital Section, American Society of Range Management.

Frank A. Biberstein, Jr., professor of civil engineering, was a member of the Advisory Panel for the New Laboratory Equipment Program to the NSF, which met in Washington February 4-5.

George Washington University

During the week of January 4, **Benjamin D. Van Evera,** in company with Acting President Colclough and Meredith Crawford, director of the Human Resources Research Office, visited GWU's Human Resources Research Units at Fort Knox, Rucker, and Benning, for conferences and demonstrations of the work these units are doing in the field of Army training.

On behalf of the Washington Board of Trade, **Dean Martin A. Mason** is directing a study of desirable improvements in graduate study opportunities in the Washington area. The purpose is to strengthen and improve the attraction of the area for private research and development companies.

Mary Louise Robbins, professor of bacteriology, was recently elected a Charter Fellow of the American Academy of Microbiology and President of the Washington Branch, Society of American Bacteriologists for 1960.

NAS-NRC

Walter H. Larrimer brought to a successful conclusion, last August, the ten-year NAS-NRC project on the production of Handbooks of Biological Data. Work on the Handbooks will be continued by the Federation of American Societies for Experimental Biology. Dr. Larrimer is now serving temporarily as a staff officer of the Division of Biology and Agriculture, in charge of arrangements for certain meetings and conferences.

Naval Research Laboratory

Herbert Friedman appeared on the CBS Conquest program, "Mystery of the Sun," on January 24, illustrating the background of, and recent advances in, rocket astronomy.

Dr. Friedman was recently elected to the Board of Directors of the American Rocket Society for a three-year term beginning January 1. On January 27 he attended the Board's first 1960 meeting in New York City.

Richard Tousey attended the First International Space Science Symposium of the Committee on Space Research (COSPAR), held recently in Nice, France, and presented a paper, "The UV Spectrum of the Sun." This paper reported recent rocket spectrograms in the range 500-1800A.

Horace M. Trent gave two talks at Virginia Polytechnic Institute on January 18. He addressed the Mathematics Club on "Some Contributions of Mathematics and Mathematicians to the Work Carried on at the U. S. Naval Research Laboratory"; and he addressed the Naval Research Reserve Unit on "The Functions of the Naval Research Laboratory as set up under the Office of Naval Research."

George R. Irwin and **J. A. Kies** presented a paper, "Fracture Theory as Applied to High Strength Steels for Pressure Vessels," at the Golden Gate Metals Conference, held in San Francisco February 4-6. On February 15 Dr. Irwin and **J. S. Srawley** presented a paper, "Brittle Frac-

ture," before the American Institute of Mining, Metallurgical, and Petroleum Engineers in New York City.

Smithsonian Institution

The American Ornithologists' Union has presented the Brewster Award—its highest honor—to **Alexander Wetmore,** research associate and former secretary of the Smithsonian Institution. This award was granted at the Union's 77th Stated Meeting, held August 25-30 in Regina, Saskatchewan. The citation read in part: "In Alexander Wetmore we hail a biologist who, during a career that now spans more than 50 years, has been one of the chief architects of American ornithology."

USDA, Beltsville

Bernice G. Schubert has been appointed technical editor of *Economic Botany,* effective February 1. This journal is now the official organ of the new Society for Economic Botany, formed last summer.

Erwin L. LeClerg, director of biometrical services, Agricultural Research Service, served as chairman of a meeting of Agricultural Experiment Station statisticans, held concurrently with the annual meeting of the Biometric Society in Washington, late in December. Dr. LeClerg was elected to serve again as chairman of this group at its next meeting, at Stanford University next August.

John H. Martin and **Reece I. Sailer** served as members of a USDA team that visited India, Pakistan, and Egypt during October and November, 1959, to negotiate grants for agricultural research by scientific institutions in these countries. The grants will be financed by Public Law 480 funds received from sales of surplus farm products.

Myron S. Anderson, before his retirement an employee of the Agricultural Research Service, has accepted an invitation from William Penn College, Iowa, to conduct a short course next May on the topic, "Soil and Civilization." He has prepared a syllabus designed to present soil science as a cultural subject, suitable for consideration in a liberal arts college.

J. L. Lowe and **R. L. Gilbertson** of the New York School of Forestry were guest workers at Plant Industry Station for two weeks in January, in cooperation with the Forest Disease Research Laboratory and the National Fungus Collections. Both men are specialists in the classification of Polyporaceae, one of the principal groups of wood-rotting fungi.

Paul R. Miller has been appointed to the Editorial Committee of *Annual Reviews of Microbiology* for a five-year term effective January 1.

Lawrence Zeleny of the Grain Division, Agricultural Marketing Service, spoke before the Chesapeake Section, American Association of Cereal Chemists, at its meeting on January 28. Dr. Zeleny's topic, "Wheat Quality Requirements in Asia and Europe," was based upon observations during his trip to Japan, Hong Kong, India, Pakistan, Holland, Germany, and England during the summer of 1959, under the sponsorship of USDA's Foreign Agricultural Service and the Great Plains Wheat Market Development Association.

John W. Mitchell has been appointed head of the Growth Regulator and Antibiotic Laboratory of the Crops Research Division, Agricultural Research Service. Dr. Mitchell, who described his research on plant regulators to Premier Khrushchev during the latter's visit to the United States, has recently published several papers on absorption and trans-location of agricultural chemicals by plants, and on methods used in studying responses of plants to regulating chemicals.

Arthur W. Lindquist represented the Entomology Research Division, Agricultural Research Service, at a meeting of the WHO Committee on Insecticide Evaluation held at Geneva, November 30-December 5. The committee consisted of single representatives from seven research organizations. Purpose of the meeting was to plan how WHO could speed up evaluation

of insecticides for control of *Anopheles* mosquitoes that are resistant to DDT, dieldrin, and BHC.

USDA, Washington

Hazel K. Stiebeling was a member of the U. S. delegation to an FAO conference in Rome, November 1-21, 1959, serving as advisor on matters relating to human nutrition and home economics.

Wilbur T. Pentzer attended the 10th International Congress of Refrigeration, held in Copenhagen last August, as a delegate appointed by NAS-NRC. At the Congress, he was elected vice-president of the Technical Board for the International Institute of Refrigeration, 1959-63, and vice-president of Commission 4, which deals with the refrigeration of foods and other agricultural commodities.

Dorothy Nickerson is author of a paper, "Light Sources and Color Rendering," which appeared in the January issue of the *Journal of the Optical Society of America*. The paper summarizes progress on industrial and agricultural problems concerned with good color rendering of light sources, including progress being made nationally by a committee of the Illuminating Engineering Society and internationally by a committee of the International Commission on Illumination.

Edson J. Hambleton attended the Sixth Session of the FAO Desert Locust Control Committee meeting, held in Rome June 29-July 4, 1959. After the meeting, he made an inspection tour of Regional Insect Control Project operations in Tunisia, Libya, the Sudan, Ethiopia, Lebanon, and Iran.

Last December, Dr. Hambleton attended the annual conference of the Regional Insect Control Project, held in Beirut, Lebanon, and afterward inspected project operations in Ankara. The Control Project is operated by USDA's Plant Pest Control Division in cooperation with ICA.

Joseph R. Spies attended the annual meeting and postgraduate course of the American Academy of Allergy, held at Hollywood, Fla., January 10-13.

On November 3, **Kenneth W. Parker** presented an illustrated talk, "Recent Advances in Range Management Research," before the Botanical Society of Washington. On December 16 Dr. Parker gave his impressions of New Zealand in a talk, "Life Down Under," presented to the Bethesda-Chevy Chase Chapter of the Izaak Walton League of America.

A three-week holiday in Mexico, December 19-January 8, gave **Harold H. Shepard** an opportunity to observe the considerable improvement in road and lodging conditions since his last visit in 1957. In some areas, the economic condition of the people also appeared better. An informal visit to the archeological site of El Tajin, near Poza Rica, was extremely interesting; Dr. Shepard recommends it to others who may desire to learn something of Mexico outside the capital city and Acapulco.

University of Maryland

S. Fred Singer, professor of physics, presented a research paper before the American Astronautical Society on January 21, during its Sixth Annual Meeting in New York City. His topic was, "The Radiation Belts of Planet Mars and Venus."

Monroe H. Martin, director of the University's Institute for Fluid Dynamics and Applied Mathematics, has been appointed honorary lecturer in mathematics at St. Salvator's College in Scotland. Currently on a year's sabbatical leave from Maryland, Professor Martin is now at St. Andrews, Scotland, where he is carrying on studies on the uniqueness of solutions to linear and non-linear boundary problems for partial differential equations.

Retirements

Benjamin Schwartz of the Animal Disease and Parasite Research Branch, Agricultural Research Service, retired November 30 after more than 43 years in Government service. Dr. Schwartz, whose maj-

or interests and contributions lay in the fields of parasitology and helminthology, received his formal education at CCNY, Columbia University, and GWU (Ph.D., 1920). He spent several years in the Philippines, where he served as professor of parasitology at the University of the Philippines, director of hookworm research for the Philippine Health Service, and co-editor of the Philippine Journal of Science. He was U. S. delegate to the International Congress of Tropical Medicine and Malaria in 1948, and president of the American Society of Parasitology in 1951. Dr. Schwartz plans to remain in Washington, and to write a book on parasitology and helminthology.

Deaths

Word was recently received at the Academy office of the death on July 23, 1959, of **C. E. Van Orstrand,** a retired member who had been living in Manito, Ill., since 1947. Mr. Van Orstrand, formerly with the Geological Survey here, was elected to the Academy in 1909.

AFFILIATED SOCIETIES

American Institute of Electrical Engineers, Washington Section

Chairman: Wade M. Edmunds (REA). *Secretary-Treasurer:* Irvin L. Cooter (NBS). Meetings in PEPCO Auditorium, 10th and E, N.W., 8:00 P.M. on 4th Tuesday.

March 22, "Modern Automatic Dispatching for Electric Power Systems," R. L. Tremaine, Westinghouse Electric Mfg. Co.

American Meterological Society, District of Columbia Branch

President: Jack C. Thompson (WB). *Secretary:* Raymond McGough (USN Hydro. Off.) Meetings at NAS-NRC, 2101 Constitution Ave., N.W., on 3rd Wednesday.

March 16, "The Tracks of Tropical Hurricanes," William Haggard, U.S. Weather Bureau.

American Society for Metals, Washington Chapter

President: William L. Holshouser (NBS). *Secretary:* Glenn W. Geil (NBS)

March 21, "Pressure-Induced Transformations in Metals," John E. Hilliard, General Electric Company.

American Society of Civil Engineers, National Capital Section

President: W. O. Hiltabidle. *Secretary:* Daniel P. Jenny. Meetings usually in John Wesley Powell Auditorium

Chemical Society of Washington

President: Allen L. Alexander (NRL). *Secretary:* John L. Torgesen (NBS).

The Board of Managers met on January 14 at the Cosmos Club, with incoming President A. L. Alexander presiding.

Dr. Alexander introduced the Society's guest of the evening, Aristid von Grosse of Temple University, who was later to address the general meeting. He also introduced new members of the Board and several new chairmen of standing committees.

The minutes of the December 13 meeting were read by retiring Secretary W. J. Bailey, and approved. The financial report for 1959 was presented by Treasurer S. B. Dewiler, Jr.; this showed income of $4,147 and expenses of $3,474, with year-end balances of $1,000 in the checking account) $6,198 in the savings account, and $8,511 in the ACS Cash and Investment Pool.

Dr. Bailey stated that a summary annual report of the secretary for 1959 would be read at the general meeting, and that a comprehensive annual report was expected to be completed and forwarded to the American Chemical Society about February 1.

Chairman C. R. Naeser of the Budget Committee presented a 1960 budget of $3,670, stating that it was based on an anticipated allotment from the American Chemical Society of $3,731. Principal changes from 1959 involved increases in

the Hillebrand Award and the Education Committee budget, and decreases in the Entertainment Committee budget and the councilors' travel fund. The budget was accepted by the Board.

J. M. Leonard reported for Chairman Leo Schubert of the Education Committee that $1,600 was expected to be available to pay for bus fare and lunches for high school students who will engage in research projects at NIH next summer. Of this amount, $1,000 will be contributed by the Washington Junior Academy of Sciences and $300 by the senior Academy, while $300 has been authorized by the Chemical Society of Washington. It is anticipated that 20 students may be subsidized with these funds.

Chairman P. J. Hannan of the Entertainment Committee reported on arrangements for the February 11 Board meeting at Caruso's Restaurant, and for the Hillebrand Award dinner on March 10 at the Presidential Arms. In an effort to publicize the dinner, an art contest for posters is being sponsored in colloboration with the Art Academy. After the contest, the posters will be displayed at various insitutions.

Chairman W. A. Zisman of the Programs Committee reported on tentative program plans for 1960. Dr. Bailey announced that the joint meeting with the ACS Maryland Section would be held on Friday afternoon and evening, May 6. The meeting is expected to have co-chairmen, symposia, and twice the number of papers as at the regular May meeting of CSW.

Chairman R. P. Maickel of the Public Relations Committee reported on the Committee's recent survey of other ACS local sections, to determine the use by newspapers of academic titles in referring to scientists. About half of the sections responded; they indicated that of 204 newspapers surveyed, only eight liimted the use of the title, "Doctor," to the medical profession and the clergy.

Insecticide Society of Washington

Chairman: Milton S. Schechter (Ag. Res. Cent.) *Secretary-Treasurer:* James F. Cooper (Plant Ind. Sta.) Meetings in Symons Hall Auditorium, 8:00 P.M. on 3rd Wednesday

Medical Society of the District of Columbia

Secretary: Theodore Wiprud
Meetings in auditorium of Medical Society Building, 1718 M St., N.W.

Society for Experimental Biology and Medicine, District of Columbia Section

President: George A. Hottle (NIH). *Secretary:* Edwin P. Laug (FDA)

April 7, meeting in Hall A, G. W. Univ. School of Medicine, 1335 H St., N.W.

Society of American Foresters, Washington Section

Chairman: James M. Owens

Mar. 17. "The National Wood Promotion Program", Mortimer B. Doyle, Exec. V. Pres., National Lumber Manufacturers Assoc., Washington, D.C.

Washington Society of Engineers

President: Adm. Charles Pierce (CDS). *Secretary:* William R. Ganser, Jr.

Feb. 3, "The Bulldozer and the Rose," Dana E. Doten, USPHS, and Garnet W. Jex, USPHS.

ACADEMY ACTIVITIES

New Members Since October 1959

Akers, Robert P.
National Institutes of Health
Allen, William G.
Maritime Administration
Birks, L. S.
Naval Research Laboratory
Buras, Edmund M., Jr.
Harris Research Laboratories
Burke, Bernard F.
Carnegie Institution of Washington
Crafton, Paul A.
George Washington University
Dawson, Reed
Department of Defense

Drummeter, Louis F., Jr.
Naval Research Laboratory
Haines, Kenneth A.
Agricultural Research Service
Hauptman, Herbert
Naval Research Laboratory
Karle, Isabella
Naval Research Laboratory
Karle, Jerome
Naval Research Laboratory
Krasny, J. F.
Harris Research Laboratories
Kruger, Jerome
National Bureau of Standards
Menkart, John
Harris Research Laboratories
Newton, Clarence J.
National Bureau of Standards
Orem, Theodore H.
National Bureau of Standards
Shen, Shan-fu
University of Maryland
Voss, Gilbert L.
Marine Laboratory, Miami, Fla.
Weil, George L.
Consultant, Washington, D. C.
Yaplee, Benjamin S.
Naval Research Laboratory
Yuill, Joseph S.
Forest Service, Beltsville, Md.

Reinstatement

Withrow, Alice P.
National Science Foundation

Corrections to 1959 Directory

Name	*From*	*To*
Ford, Tirey F.	1AW	1DNRL

JOINT BOARD

As part of the program supported by a grant from the National Science Foundation to the Washington Academy of Sciences, the Joint Board on Science Education is holding a series of curriculum conferences. The purpose of these is to bring together high school teachers, college instructors, and scientists to discuss problems in science education.

The agenda of these conferences consist of informal discussions on such topics as: problems in high school teaching arising from the need for college preparation; problems in college teaching owing to high school preparation; establishing better liaison between high school teachers, college instructors, and the scientific community on matters related to science and mathematics teaching.

In order to facilitate active participation of all attendees, the conferences have been limited to about 30 persons equally divided among the three types of participants. Three area conferences—Maryland area, D.C. area, and Virginia area—have been held for each of the disciplines of biology, chemistry, mathematics, and physics, or 12 in all. Participants met on Saturdays from 9:30 to 4:00 P.M. A group luncheon was sponsored by the Joint Board. The biology meetings were held in public schools while the chemistry groups met at three different universities. Private schools were chosen for the sites of the physics conferences, and government and private laboratories were hosts to the mathematics meetings.

The second phase of the program is now in progress. This consists of one area-wide summary conference in each of the four disciplines. To these have been invited representatives from the preceding conferences and, in addition, a few persons from national scientific societies who are particularly interested in secondary education.

Dr. Falconer Smith of NIH, who is also Chairman of the Joint Board, has chaired all of the conferences in biology; Dr. John K. Taylor of NBS presided at the chemistry conferences. Dr. Franz Alt of NBS has been chairman of the mathematics meetings, while Dr. Raymond J. Seeger of NSF has presided at the physics discussions.

The final phase of the conferences will be a meeting between science and mathematics supervisors of the local school systems and the chairmen of the preceding conferences. Dr. Raymond J. Seeger, chairman of the Joint Board's curriculum committee will preside. One objective of this

meeting will be to explore ways in which the Joint Board and the local scientific comunity can establish better liaison with the schools.

SCIENCE AND DEVELOPMENT

High-purity tungsten can now be easily plated on metal surfaces by using a vapor deposition process developed for the Navy by the National Bureau of Standards. The method, devised by W. E. Reid and Abner Brenner of the Bureau's electrodeposition group, involves reducing gaseous tungsten hexafluoride with hydrogen by passing it over the heated object to be plated. At temperatures above 300°C., tungsten is deposited on the hot surface, and the only other reaction product, hydrogen fluoride, passes out with the excess of hydrogen.

Geophysicists Rutledge Brazee and Frank Werner, of the Coast and Geodetic Survey, are conducting site tests in several Western States for a **suitable location of a proposed seismological laboratory.** Some of the states that are being surveyed are Colorado, New Mexico, Wyoming, Arizona, and Utah. Among its activities, the new laboratory will conduct research programs in the design, development, and calibration of sensitive seismographic instruments.

A "Space Vehicles Group" that has worked together as a unit for seven years **has been added to the staff of Atlantic Research Corporation.** This group has had extensive experience—averaging over 15 years per man—in the design, fabrication, and launching of multi-stage rocket hardware for missions exploring the upper atmosphere and space beyond the earth's atmospheric blanket. Formerly with the Aerolab Development Company (now a division of Ryan Aeronautical Company), principal members of the group have participated in major space projects such as "Argus," in which three atomic bombs were exploded at a 300-mile altitude over the South Atlantic.

Catholic University has begun construction of a new building for the School of Engineering and Architecture. The Engineering Library and the Departments of Civil, Chemical, Electrical, and Mechanical-Aeronautical Engineering, at present located in several buildings, will be housed in the new structure.

The Biology Department of Catholic University is offering a new course, **"Radioisotopes in Biology,"** in the spring semester, 1960. Part of the instrumentation necessary for the course was provided by a grant from the Atomic Energy Commission.

Proprietary medicines have a long and flamboyant history. Some of the fantastic extremes of the past are cited in a study of old English patent medicines which had a wide use in the American colonies, recently published by the Smithsonian Institution. It is the work of George B. Griffenhagen of the American Pharmaceutical Association, and James H. Young of Emory University. Such English nostrums as Daffy's Elixir Salutis, Turlington's Balsam of Life, Steer's Opodeldoc, Hooper's Female Pills, and Bateman's Pectoral Drops appealed to the busy colonial settlers with little time and small means. The proprietors pioneered in both advertising psychology and the development of distinctive packaging. The popularity of these remedies, some of which have lasted into our own century, owed much to the fact that though the ingredients inside varied (unbeknownst to the customer), the shape of the bottle did not.

In a wind-blown, white sand desert of northern South America—the great Guajira Peninsula—a nomadic, polygamous, matrilineal race of Indians has maintained its independence and ways of life for nearly 500 years. The people of this cultural island, **the Guajiros, are described by Raymond E. Crist of the University of Florida, in a report recently published by the Smithsonian Institution.** A notable characteristic of these people is the survival of the matrilineal, polygamous family. A man acquires a wife by pur-

chase from her family, paying in cattle, jewelry, etc.; hence a girl child represents a certain wealth to her parents, while a boy child represents an economic drain. Blood relationship is traced almost entirely through the mother.

The forthcoming seventh edition of the *Merck Index*, an outstanding chemical reference book, is scheduled for publication in March. This unique encyclopedia of chemicals and drugs, now containing 1,600 pages of text, has been published by the Merck organization for more than 65 years, and has become a standard reference work for chemists, pharmacists, physicians, dentists, veterinarians, botanists, and members of allied professions. The prepublication price of the new edition is $11.

A grant of $22,388 has been awarded by AEC to the University of Maryland Physics Department for purchase of equipment to be used mainly in training senior physics students in an atomic and nuclear energy course. Students also will be enabled to use other facilities such as the Department's Van de Graaf accelerator and related equipment purchased from University funds.

A bibliography on plasma physics and magnetohydrodynamics, the first book to be compiled on the subject, has been published by the University of Maryland. Prepared by James D. Ramer, a former librarian at Maryland, the publication contains over 1700 subject titles, an author index, and a numerical index to international atomic energy reports.

Total domestic iron-ore resources of the United States have been placed at about 75 billion long tons of crude ore, according to recent estimates by Geological Survey scientists. Of this amount, about 10 billion tons is classed as reserves—material usable under existing economic and technologic conditions. The remaining 65 billion tons is potential ore—material likely to become available under more favorable conditions. The potential ore may yield 25 billion tons of concentrates and direct-shipping ore.

LETTERS TO THE EDITOR

February 11, 1960

I regret to note the erroneous impression given on pg. 26-27 of the January 1960 issue of the *Journal of the Washington Academy of Science* to the effect that the meeting on December 14 was "between Academy officers and a number of members from the Smithsonian Institution". We made it entirely clear at that meeting that the individuals with whom the officers conferred represented the Geological Survey (Paleontology and Stratigraphy Branch) and the Department of Agriculture (Insect Identification and Parasite Introduction Laboratories) as well as the Smithsonian Institution. As you well know, the Institution provides quarters for staff members of these groups (and also for certain Fish and Wildlife scientists whose viewpoint was implied at our meeting), but they are in no sense to be considered "Smithsonian members".

The quoted notes imply that the viewpoint expressed on December 14 was a Smithsonian viewpoint: this is an error of fact, as a much wider group of scientists was represented. I wish to object to the misrepresentation of the viewpoint as coming only from "Smithsonian members".

An objection must also be registered to the implication that the scientists at the December 14 meeting wish the Journal to contain ". . . chiefly scientific material of a descriptive character, . . .". Our viewpoint was unmistakably stated as favoring the publication of scholarly contributions within the fields of interest of *all members*, without discrimination and insofar as finances permit.

A. C. Smith, Director,
Museum of Natural History
Smithsonian Institution.

Editor's note. This column is now available to Academy members for comments, criticism, statements of policy, and proposals about either the *Journal* or Academy actions. Contributions should be limited to 100-200 words and sent directly to the Managing Editor.

ACADEMY ANNUAL MEETING–1960

AWARD WINNERS AND GUESTS: *(reading from left to right)* ***TOP ROW:*** **Betty Schaaf,** science teaching award; **Helen L. Garstens,** science teaching award; **Harvey R. Chaplin, Jr.,** engineering sciences award; **Frank L. Campbell,** President, 1959-60; ***MIDDLE ROW:*** **Dwight W. Taylor,** biological sciences award; **Geoffrey S. S. Ludford,** mathematics award; **Alan C. Kolb,** physical sciences award; **David Chen,** President, Washington Junior Academy of Sciences. ***BOTTOM ROW:*** **Ralph B. Kennard,** chairman, Committee on Meetings; **Thomson King,** Director, Maryland Academy of Sciences; **W. Doyle Reed,** member, Committee on Meetings. *(Photos by Pat Krauss)*

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